# PATENT SPECIFICATION

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**703,745**

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COMPLETE SPECIFICATION

## Improvements in or relating to Method of and Machine for Filling Packages with Powdered Material

We, AMERICAN CYANAMID COMPANY, a Corporation organised under the Laws of the State of Maine, United States of America, of 30, Rockefeller Plaza, New York, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of and a machine for filling packages with powdered material.

The invention contemplates the formation of a series of packages from continuous sheets of packaging material such as paper, regenerated cellulose, metal foils such as aluminum foils, thin plastic films such as glassine, and rubber hydrochloride sheets, and is particularly useful in conjunction with a thermoplastic resin coated foil strip. Pressure sensitive strips may be used which seal to each other under the influence of pressure without the necessity for using heat. Paper strips coated with latex may be used as these will adhere under the influence of pressure. A thermoplastic resin coated sheet is preferred, such as for example, aluminum foil which is coated with rubber hydrochloride or polyethylene or other thermo-sealing resin, either thermo-setting or thermo-plastic, which will seal under the influence of pressure and heat as such sheets are passed between sealing rolls, preferably having serrated surfaces.

Many inventors, over a long period, have been attempting to form such packages. An object of the present invention is to render the operation more economical, particularly with medicinals, and to make it possible to decrease the variation between individual increments of container content.

Machines are well known for making and filling packages in which oscillating serrated grips are used to seal together sheets to form an open-ended container in which a powder charge is filled and then the top sealed so as to complete the container. Such machines may employ a rotating drum charge chamber providing for volumetric measurement of the charge.

Other machines are known which provide for the continuous formation of a tube and the filling thereof with liquid. Many forms of metering devices and volumetric traps are shown by the prior art, as for example the volumetric traps used when packages are formed and severed by an oscillating die mechanism and filled by a dump-valve mechanism.

The sealing mechanism shown in Salfisberg U.S. Patent No. 2,374,504 involving interdigitated serrations on gear coupled heated rolls is particularly useful. This patent shows the use of guard rings on the serrated rolls to protect the serrations and insure the proper spacing. It also shows a spring-loading of the rolls to provide for variations in the machine. This type of sealing mechanism may be incorporated in the present invention if desired.

Certain previous types of machines have used augers to feed a powder. An augerdoes not deliver a uniform flow of powder, and will work only with certain types of powder.

Prior inventors have to a large extent used volumetric traps of various natures in which a powder was permitted to flow into a measuring chamber and then discharged from the measuring chamber to the packages. This type of measurement is fairly satisfactory for powders which are free-flowing, which do not bridge, block or bind and which do not become tacky, if the powders are of uniform

[*Price*

density and the accuracy of fill not important. However, under many circumstances, it is desirable to fill powders which are not free-flowing and which may become tacky, as for example, many hygroscopic medicinals, and very fine powders which bridge. Furthermore, with powders of high unit value or in processes where the quantity involved is critical, an ordinary volumetric trap is not adequate.

In accordance with the invention a method is provided of packaging powdered material which comprises passing under a powder-containing hopper measuring chambers of uniform size, having at least a portion of their surfaces formed of a foraminous material, withdrawing the gas present in the measuring chambers through said foraminous material while under the hopper, successively moving the measuring chambers past a doctor means and out of communication with said hopper, whereby the measuring chambers are uniformly filled with a powder, moving the powder-filled measuring chambers to a discharge position ejecting the powder charge by placing the latter under gaseous pressure, passing at least one continuous sheet of packaging material, at least one side of which is sealable to itself under the influence of heat and pressure under the discharge position, adhering said material to itself by the application of heat and pressure so as to form open-ended containers under the discharge position, discharging at least one powder charge into each of said open-ended containers and sealing under the influence of heat and pressure the thus filled containers above their powder contents. Also in accordance with the invention a machine is provided for packaging powdered material comprising a powder hopper, a rotary turret provided with a plurality of measuring chambers adapted to rotate under said hopper, a foraminous material comprising at least a portion of the surface of each of such measuring chambers, means for withdrawing the gas present in the measuring chambers through said foraminous material, means for rotating the turret and thereby moving the said measuring chambers past a doctor means and to a discharge position, gaseous pressure change means for discharging the powder charge of said measuring chambers into containers, means for passing at least one continuous sheet of packaging material under said turret, and means for forming open-ended containers from said sheet and for sealing the containers above their powder contents after they are filled, said means for rotating the turret being adapted to operate in timed relationship with said container forming means.

The machine of the present invention is so accurate that under many circumstances, the increase in accuracy is sufficient that filling operations which formerly had to be made by actual weighing each individual charge can now be made rapidly by our device.

The machine of the present invention additionally provides an adjustment so that the contents of a measuring chamber may be retained in position by the influence of suction until the measuring chamber is at a desired release point. Here, for free-flowing powders, the release of the vacuum permits the powder to fall from the measuring chamber. It is preferably to use a positive gas pressure to insure that powders, whether free-flowing or not, will be discharged at the same point. By adjusting an angular seal between pressure and vacuum chests, it is possible to cause the release of the powders at the exact portion of the travel of the measuring chamber which is desired and this discharge point may be adjusted while the device is in operation. For greater efficiency, it is desirable that the charge fall directly into the container. If the speed of rotation is to vary over wide limits, it is desirable that the release point be variable while in operation so that the powder charge can be caused to drop to the exact point desired. Furthermore the machine of the invention is provided with an adjustment in the timing between the container-forming rolls and the rotary turret containing the measuring chambers so as to adjust the timing to compensate for any variation in fall of the powder charge between the release point and the container-forming rolls.

In order that the invention may be fully understood, it will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a front elevational view of a machine embodying the invention;

Figure 2 is a side view of the machine showing the metering mechanism in partial section along line 2—2 in Figure 1;

Figure 3 is an end view of the stator;

Figure 4 is a left side view of the stator;

Figure 5 is a pictorial view of the rotary turret including the measuring head drum and the measuring head spider;

Figure 6 is a view of the turret drive mechanism showing the means for providing timing adjustment.

### Package Sealing Mechanism

Two continuous sheets of sealable packaging material, 11 and 12, are fed in from suitable sources, not shown, over the left and right guide rollers, 13 and 14. These guide rollers may be non-powered idlers. From them the sheets travel downwardly in a V-shaped configuration towards the bite of the left and right seal rolls, 15 and 16. The seal rolls, which may be of the type shown in the Salfisberg U.S. Patent No. 2,374,504, are attached to the left and right seal roll shafts, 17 and 18, which shafts may be suitably journalled in front and rear frames, 19 and 20, which frames may be attached to or made integral with a suitable base 21. The seal roll shafts are geared to each other by the left and right seal roll drive gears, 22 and 23. The right seal roll drive gear 23 shows in Figure 2. The left seal roll drive gear, 22, is directly behind it in this view.

One of the seal roll shafts, for purposes of illustration the left one, is shown as driven by a suitable motor 24 through a worm gear 25 which in turn drives a main drive spur gear 26. Other forms of drive may obviously be used. The seal rolls themselves, 15 and 16, are provided with a serrated surface 27 which serrations are interdigitated so that the two sheets are pressed firmly together and caused to join. It is possible to cause the sheets to seal to each other by merely the application of pressure between smooth rolls but the serrations give higher unit pressures, provide for better heat transfer, and insure a more complete trouble-free, vapor-proof seal than is obtained without their use.

The rolls may have provided guard rings 28, which are smooth rings to the front and the rear of the serrated portions between which the sheets pass so that the serrated rolls are properly spaced without regard to the sheet material passing between. These guard rings are not necessary and may advantageously be left off if sheet material of variable thickness is to be used.

The serrated surfaces are provided with complemental recesses 29, which recesses are adapted to receive the powder contents of the formed containers. Springs or sponge rubber may be used in these recesses to aid in excluding air from the containers as formed, but usually the tension in the sheet is sufficient to express air from the packages as filled. The serrated surfaces may be heated by any suitable means, for example, as diagrammatically shown, lead wires 30, connect to internal resistors in the seal rolls. The serrated surfaces form sealing areas which cause the areas of the sheets with which they come in contact to adhere to each other.

As the sheets 11 and 12 are fed down into the bite of the seal rolls, the serrated surfaces cause a sealing zone to be formed entirely across the two sheets and then as the complemental recesses 29 pass through the bite, the sheets are sealed to each other only at the edges, leaving an unsealed zone in the middle forming a container to receive the powder contents. After the powder contents are filled between the sheets, the complemental recesses pass through the bite of the rolls and the full seal roll surface again causes the two sheets to be sealed entirely across, thereby completing the container in which the powder is sealed. The thus formed packages 31 are illustrated in Figure 1.

Cutting means may be included in the sealing rolls so that individual packages are separated if desired. To assist in insuring that all of the powder charges fall into the containers being formed by the seal rolls, there are provided powder deflectors, 32 and 33, on each side of and above the sheets as they are fed into the rolls. One of the seal roll shafts may be spring-mounted to provide for flexibility in operation.

### Powder Measuring Apparatus

Above the seal roll shafts is a turret shaft 34 which is suitably journalled in the front and rear frames. On the turret shaft is fixed a positioning ring 35. Removably mounted on the end of the shaft and resting against the positioning ring is the measuring head drum 36. A key 37 causes the measuring head drum to rotate with the turret shaft. The measuring head drum has a series of measuring chamber slots 38, the main portions of which are of uniform cross-section. At the bottom of the measuring chamber slots is a foraminous material 39 which extends over the main portion of the bottom of the slot. At the front of the foraminous material is a positioning block 40. The foraminous material is preferably of a sintered metal which is porous but yet solid and inflexible. Such sintered metals may be formed by heating powdered metals almost to their melting point in an inert atmosphere and are well known in the arts. Sintered glass or a felt or fabric partially impregnated with a plastic may be used, but the sintered metal is usually more resistant and will wear longer.

In forming the measuring head drum, it is convenient to use an end mill to form a T-slot into which a suitably shaped block of the foraminous material, prefer-

ably sintered metal, is placed. The foraminous material should be short enough so that a positioning block 40 may be placed behind it to prevent the loss of vacuum, as later described. If these pieces are accurately formed, they may be held in place by a friction fit. Otherwise silver solder or other retaining means may be used to hold the foraminous material and the positioning block in assembled position in the measuring head drum.

After the positioning block and the foraminous material are positioned under each of the measuring chamber slots, in the drawings eight such slots are shown, the interior of the measuring head drum is turned and ground or otherwise smoothed so as to be used for a valve surface.

In each of the measuring chamber slots is a measuring chamber finger 41. The measuring chamber finger has a cross-section such that it fills the measuring chamber slot and forms a circular cylindrical surface contiguous with the external peripheral surface of the measuring head drum. The fingers are attached to and form part of a measuring head spider 42. The spider is provided with a finger in each of the measuring chamber slots and slides on the turret shaft 34. A spider positioning spring 43 tends to separate the measuring head drum and the measuring head spider. The spider is held against the force of the spring by a spider positioning nut 44 which is locked in position by a lock nut 45. The measuring head drum and measuring head spider, together with the associated foraminous material, positioning block, nuts and spring, form the rotary turret.

Interiorally of the rotary turret is a stator 46. The stator may ride on the hub 47 of the measuring head drum. The stator may fit interiorally of the measuring head drum and has an outer ring seal 48 and an inner ring seal 49. These two ring seals are connected by three radial seals as shown in Figure 3, counterclockwise, in order starting at the top, the suction chest radial seal 50, the common radial seal 51 and the pressure chest radial seal 52.

The stator fits into the interior of the turret assembly. The two rings seals, the suction chest radial seal and the common radial seal close off a portion of the volume between the measuring head drum and the stator which forms a suction chest 53 into which leads a vacuum connection 54. Adjacent is a pressure chest 55 which is formed by the outer seal ring, the inner seal ring, the common radial seal, and the pressure chest radial seal which close off a portion of the volume between the stator 46 and the measuring head drum 36 and into which leads a pressure connection 56. The inside of the measuring head drum should be smoothly finished so that the radial seals and the ring seals may ride smoothly on the surface thereof as the turret revolves, with a minimum of leakage. The stator is held in place against the inside of the measuring head drum by a stator spring 57 and is kept from rotating by a stator positioning lug 84. Above the turret is mounted a powder hopper 58 which may be of transparent material such as plastic, to enable observation of its contents. In the powder hopper there are placed agitators 59 which are driven by an agitator drive 60 from a suitable source or power which is not shown.

There is also provided an air bleed 61 which introduces air near the bottom of the power hopper to assist in maintaining aeration of the powder in the hopper. Around the outside of the hopper is a hopper seal strip 62 which may be of leather or felt, etc. and which is fastened to the outside of the hopper and rides on the surface of the turret thereby preventing powder from leaking through any slight irregularities between the hopper and the turret.

At the front of the hopper, the hopper itself may serve as a doctor blade. A separate doctor blade is usually desirable if the hopper is constructed of a soft material such as a transparent plastic.

## Turret Drive Mechanism

Freely rotating on the turret shaft is a large driven sprocket gear 63. Also on the turret shaft is a small driven sprocket gear 64. Each of these sprocket gears is connected by a drive chain 65 and 66 to separate sprocket driving gears 67 and 68 which are attached to the right seal roll shaft 18. The sprocket drive chain assembly is shown in Figure 6.

The drive chain is loose on the sprockets and the slack is taken up by a take-up idler 69 mounted in the end of a take-up arm 70 which rotates on a take-up arm pivot 71 which is mounted on the frame 19. A take-up spring 72 is attached to the lower end of the take-up arm and spring-loads the take-up idler 69, which keeps the drive chain tight. On the drive side of the chain is an adjusting sprocket 73 which is mounted in a fork in the end of an adjusting arm 74 which rotates about an adjusting arm pivot 75. The lower end of the adjusting arm has mounted therein an adjusting arm take-up screw 76 on which is an adjusting arm nut 77. A similar timing adjustment

may be provided in the other drive chain for the small driven sprocket gear 64. but is not shown, for purposes of clarity.

Mounted on the turret shaft is a turret shaft sleeve 78. A turret shaft sleeve key 79 causes the shaft and the sleeve to rotate together. A sleeve shift fork 80 is provided to shift the sleeve in either direction. At the end of the sleeve are drive notches 81 which engage lugs 82 on the respective driven sprockets.

OPERATION

In operation the sleeve shift fork may shift the turret shaft sleeve to neutral position permitting the seal rolls to rotate without the turret being rotated. This permits the adjustment of the feed sheets, temperature and operating conditions until a satisfactory seal is obtained and sturdy containers are being formed. At this time the shift fork may be biassed towards either the front or the rear so that the drive notches on the front or the rear of the drive sleeve engage either the large sprocket gear 63 or the small driven sprocket gear 64. The small driven sprocket gear 64 and the sprocket driving gear 68 are the same size so that with four pairs of complemental recesses in the sealing rolls and eight measuring chambers 83, two such chambers cooperate with each pair of recesses. If the sleeve is engaged with the large driven sprocket, the turret makes one-half as many rotations as does the seal roll, as the large sprocket gear is twice as big as the corresponding sprocket driving gear 67 and accordingly a single measuring chamber cooperates with each pair of recesses 29.

In the turret the series of measuring chambers 83 is formed by the measuring chamber slots which are partially filled with the measuring chamber fingers. By adjusting the position of the measuring head spider, the fingers are inserted into or withdrawn from the measuring chamber slots. The exact volume is determined by the position of the fingers and may be readily adjusted as may be desired. The slots should be of uniform size and the fingers of uniform size. The spider fits closely on the turret shaft so that it cannot become cocked thereon, so each of the measuring chambers is the same size and the powder charge of each measuring chamber is uniform.

As the measuring chambers rotate under the powder-filled hopper, the gaseous contents are withdrawn through the vacuum connection 54 acting through the suction chest 53 and the powder from the hopper is uniformly compacted into the measuring chamber. The front of the hopper, or a separate doctor, uniformly strikes off the contents. The contents are retained in the measuring chambers by the suction until the foraminous material forming the back portion of the measuring chamber passes the common radial seal, at which point the suction is released and if necessary, pressure applied. For free-flowing powders, pressure is not normally necessary. For powders which pack, pressure may be needed.

The powder charge in the measuring chamber is ejected therefrom as it passes the common radial seal and permitted to fall into the bite between the rolls as a container is formed from the sheets being fed to the seal rolls. The left and right powder deflectors 32 and 33, assist in causing the powder charge to fall into the container as formed. The release point at which the powder charge is dropped from the measuring chamber can be adjusted by rotating the stator about its axis. The stator is free to rotate on the hub 47 of the measuring head drum and is positioned angularly by a stator positioning lug 84 which may bear an index 85 and is held by a stator lock nut 86 which slides in a slot 87 in the frame 19. By adjusting the position of the stator and with it the position of the common radial seal, the angular position of the release of the powder charge may be adjusted so that it will fall to the desired location.

The exact position of release will vary with the speed of operation of the machine, the characteristics of the powder, etc. It is essential that the powder charges to form the powder contents of the containers arrive at the seal rolls in the proper timed relationship so that they will fall between portions of the sheets which are adjacent the recesses. At different speeds and with different powders, the rate of fall will be different. The adjusting nut 77 provides for a variation in the position of the adjusting sprocket which changes the length of the path of the travel of the sprocket chain between the driven sprocket gear and the driving sprocket gear and thus changes the relative timing between the measuring turret and the seal rolls. The exact timing of the operation is most readily adjusted while the machine is in operation, and under the guidance of an operator. Furthermore, the rate of operation of the machine may be varied and by adjustment of the timing relationship between the measuring roll and the release point, it is possible to obtain perfectly formed containers at either a slow or high speed, as may be desired.

Variations will suggest themselves to those skilled in the art. For example, the

temperatures and pressures of the sealing rolls will vary depending upon the speed of the operation and the exact material from which the sheets are formed. The powder charges may be varied in size, depending upon the depth of entry of the measuring chamber fingers into the measuring chamber slots. The size and the shape of the ends of the measuring chamber slots and the measuring chamber fingers may be varied from round, which is shown, to square or otherwise as is desired. The bottom of the slot may be either flat or cylindrical depending upon convenience in manufacture. Normally a flat bottom is easier to shape that a circular one.

The use of one or two powder charges per container is optional and permits greater flexibility in operation of the machine. The machine can be adapted to fill more increments. Where two charges are used, the timing relationship must be rather accurate to avoid part of one of the charges arriving before or after the arrival of the complemental recesses at the bite of the seal rolls.

As shown, seal rolls are used for the formation of packages. However, it will be obvious that reciprocating seal members could be used if desired.

What we claim is:—

1. A method of packaging powdered material which comprises passing under a powder-containing hopper measuring chambers of uniform size, having at least a portion of their surfaces formed of a foraminous material, withdrawing the gas present in the measuring chambers through said foraminous material while under the hopper, successively moving the measuring chambers past a doctor means and out of communication with said hopper, whereby the measuring chambers are uniformly filled with a powder, moving the powder-filled measuring chambers to a discharge position, ejecting the powder charge by placing the latter under gaseous pressure, passing at least one continuous sheet of packaging material, at least one side of which is sealable to itself under the influence of heat and pressure under the discharge position, adhering said material to itself by the application of heat and pressure so as to form open-ended containers under the discharge position, discharging at least one powder charge into each of said open-ended containers and sealing under the influence of heat and pressure the thus filled containers above their powder contents.

2. A method according to claim 1, which includes adjusting the point at which the powder is ejected so that it falls substantially directly into each open-ended container.

3. A method according to claim 1 or 2, which includes simultaneously adjusting the volume of all of the measuring chambers to compensate for any changes in powder density and to adjust to the desired container powder contents.

4. A machine for packaging powdered material, comprising a powder hopper, a rotary turret provided with a plurality of measuring chambers adapted to rotate under said hopper, a foraminous material comprising at least a portion of the surface of each of such measuring chambers, means for withdrawing the gas present in the measuring chambers through said foraminous material, means for rotating the turret and thereby moving the said measuring chambers past a doctor means and to a discharge position, gaseous pressure change means for discharging the powder charge of said measuring chambers into containers, means for passing at least one continuous sheet of packaging material under said turret, and means for forming open-ended containers from said sheet and for sealing the containers above their powder contents after they are filled, said means for rotating the turret being adapted to operate in timed relationship with said container-forming means.

5. A machine according to claim 4, in which the angular location of the gaseous pressure change means may be varied so that the powder charges are released at such a point as to most readily discharge into the containers.

6. A machine according to claim 5, in which said means comprises a radial seal between a vacuum chest and a pressure chest the angular position of which may be varied while the machine is in operation.

7. A machine according to any one of claims 4 to 6, which is adapted for relative variation of said timed relationship while in operation.

8. A machine according to any one of claims 4 to 7, in which the means for withdrawing the gas includes a vacuum chest bounded by radial seals and ring seals, said chest being located interiorally of a measuring head drum.

9. A machine according to any one of claims 4 to 8, in which the rotary turret comprises a measuring head drum having slots in the periphery thereof forming parts of the measuring chambers, the foraminous material forming the bottom parts of said slots, and permitting gas flow into the interior portion of the drum.

10. A machine according to claim 9, in which the rotary turret includes a positionable spider having fingers in each of the slots whereby the volume of the thus formed measuring chambers may be varied.

11. A machine according to any one of claims 4—10 in which the means for rotating the turret includes means for selectively changing the number of measuring chambers discharged into each container.

12. A method of packaging powdered material substantially as hereinbefore described.

13. A machine for packaging powdered materials substantially as hereinbefore described and as illustrated in the accompanying drawings.

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703,745 COMPLETE SPECIFICATION
3 SHEETS

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SHEET 1

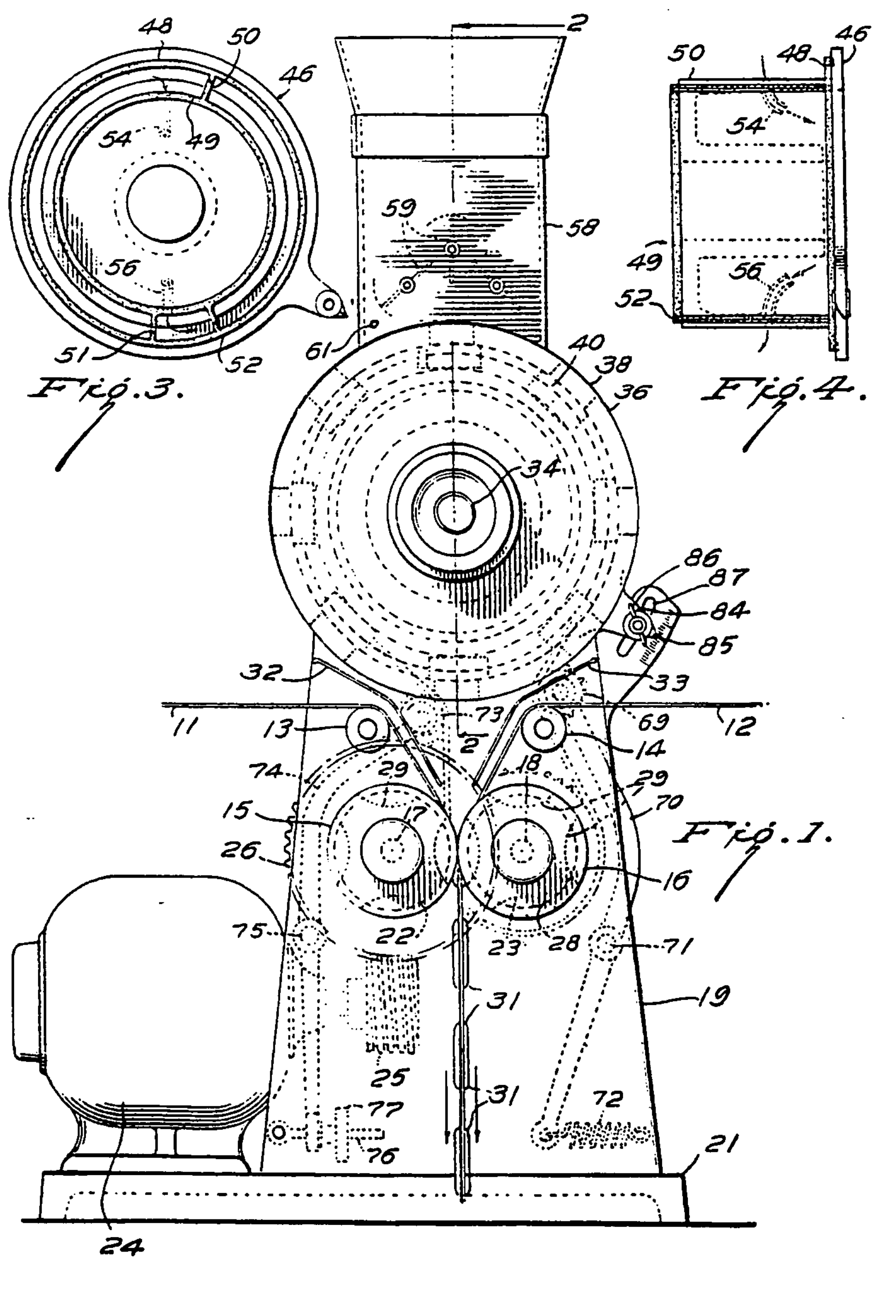


Fig. 3.

Fig. 4.

Fig. 1.

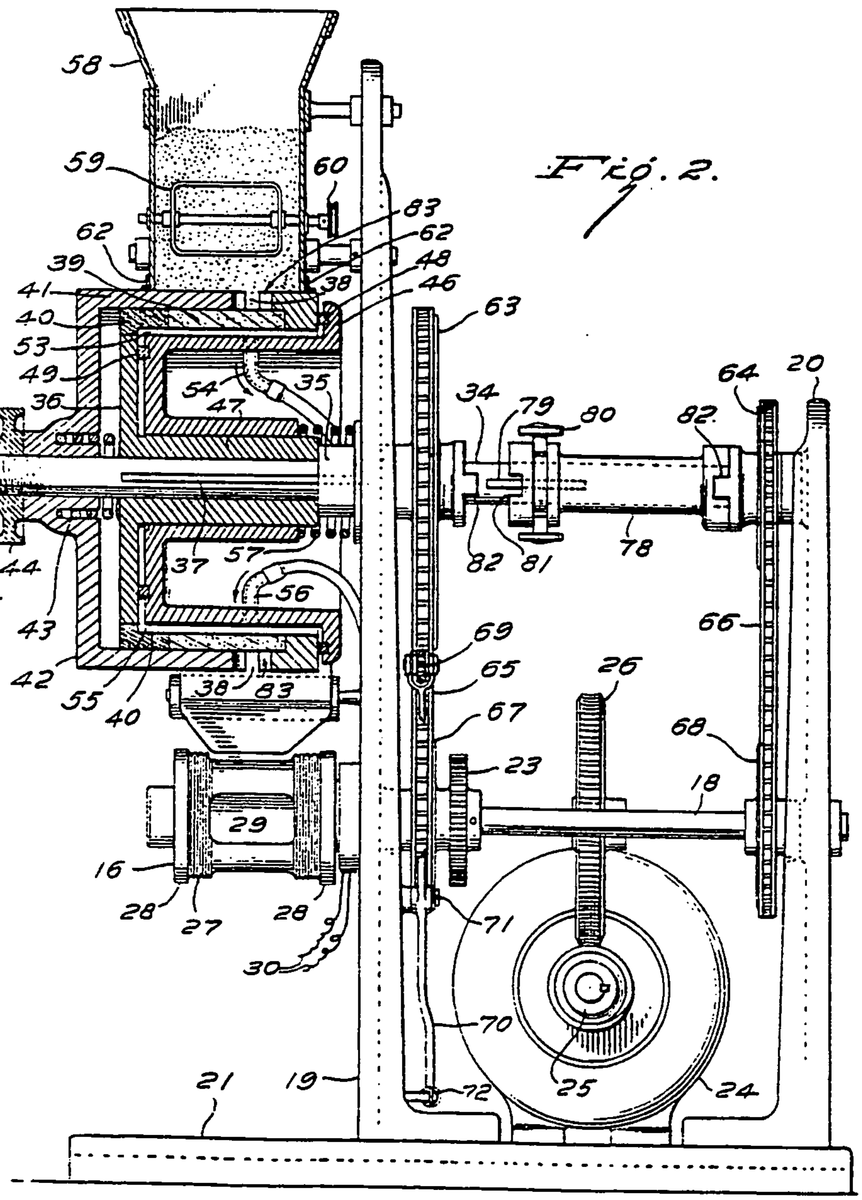
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Fig. 2.

703,745 COMPLETE SPECIFICATION
3 SHEETS
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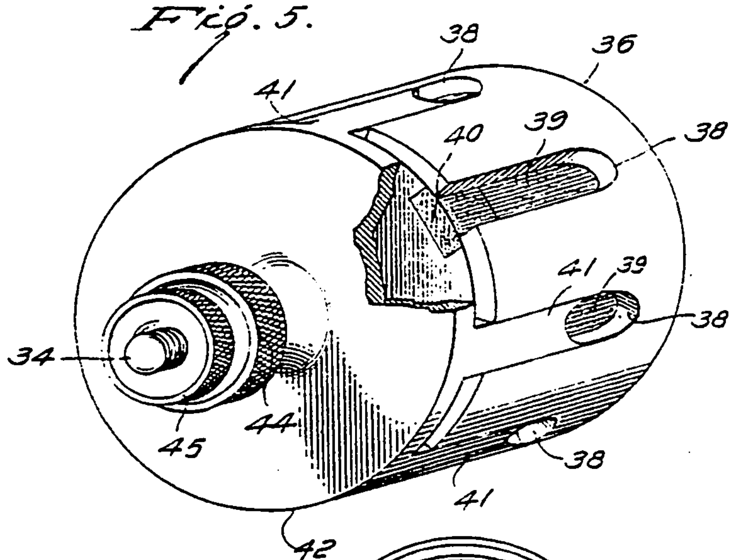
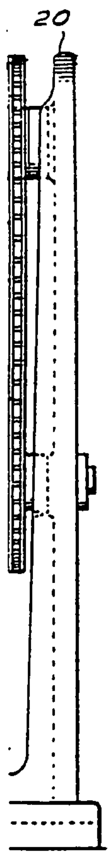
SHEETS 2 & 3

Fig. 5.



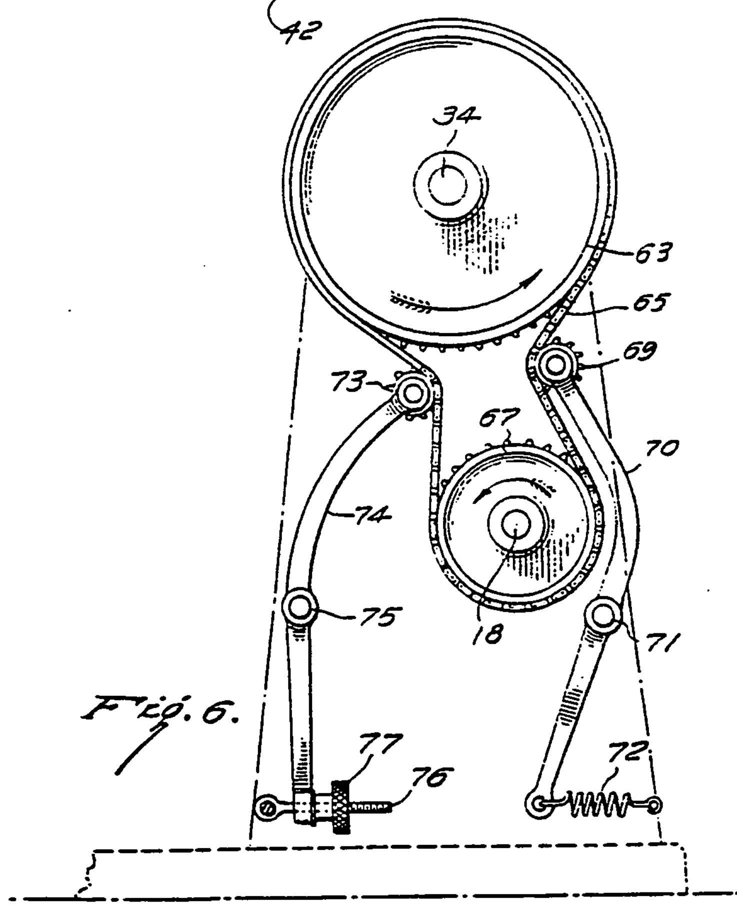




Fig. 6.

703,745 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEETS 2 & 3

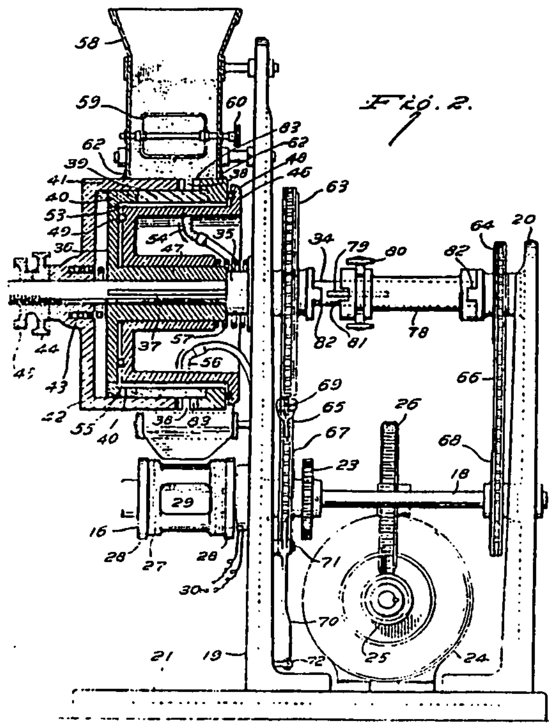


Fig. 2.

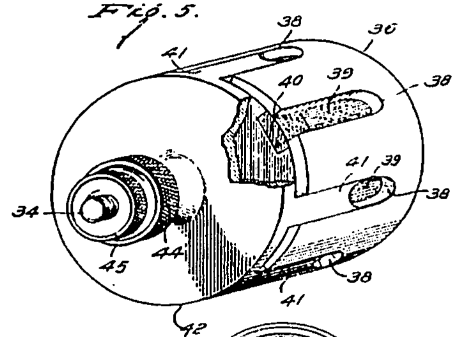


Fig. 5.

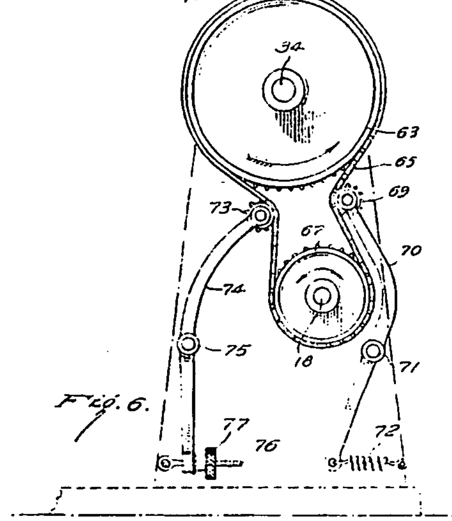


Fig. 6.

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